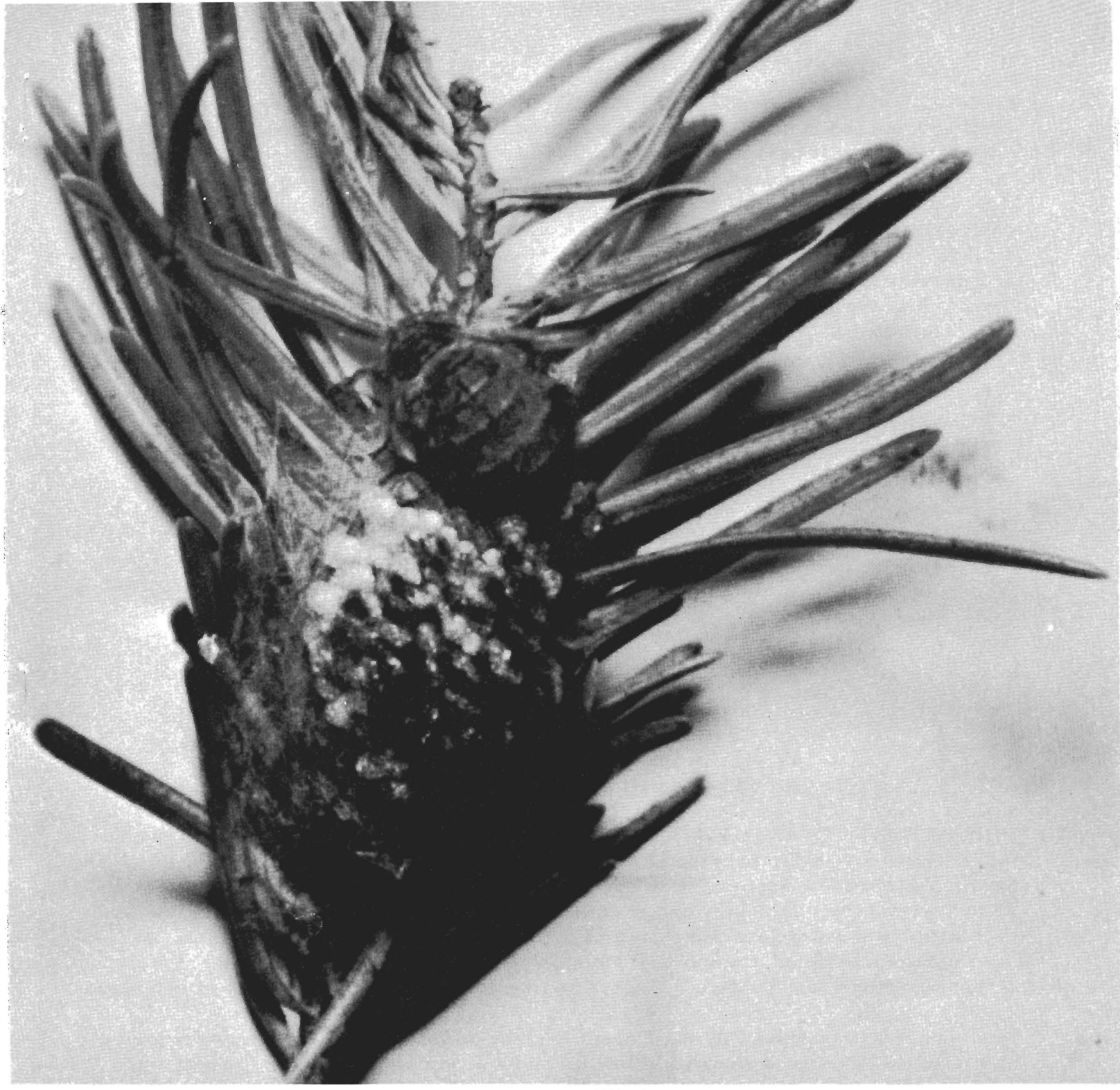


FOREST PEST CONDITIONS IN CALIFORNIA-1964

A PUBLICATION OF
THE CALIFORNIA FOREST PEST CONTROL ACTION COUNCIL

THE CALIFORNIA FOREST PEST CONTROL ACTION COUNCIL was formed in 1951 in recognition of the need for close cooperation among land managers concerned with forest pest problems. Primarily an advisory and coordinating group, the Council sponsors a Statewide cooperative forest pest detection survey; publishes an annual report of forest pest conditions; studies, endorses, and supports desirable pest control actions; reviews control needs and programs; and provides a forum for the exchange of pest control information. The California State Board of Forestry has designated the Council as its official advisory group for forest insect, disease and animal problems. The Council comprises the following organizations:

Boyce Thompson Institute
California Forest Protective Association
California Redwood Association
State of California
- Department of Agriculture
- Department of Conservation
- Department of Fish and Game
- Department of Parks and Recreation
- University of California

U. S. Department of Agriculture
- Forest Service

U. S. Department of the Interior
- Bureau of Indian Affairs
- Bureau of Land Management
- National Park Service
- Bureau of Sport Fisheries and Wildlife

Western Wood Products Association

THIS REPORT, FOREST PEST CONDITIONS IN CALIFORNIA - 1964, was based largely on information provided by the California Cooperative Forest Pest Detection Survey (in 1964, 556 reports were received: 249 for insects, 262 for diseases, and 45 for animal pest damage), and data gathered by the Forest Service Disease Survey. The latter is a systematic inventory of forest diseases on a Statewide basis employing randomly selected, temporary plots on which all trees are examined closely by forest pathologists. To date 718 plots supporting 17,950 trees have been examined.

The report was prepared by the Forest Service and the Bureau of Sport Fisheries and Wildlife in cooperation with other member organizations of the Council. It was duplicated and distributed by the California Division of Forestry.

THE COVER PHOTO: An egg mass and female tussock moth on a white fir twig.

Sacramento January 1965

HIGHLIGHTS OF FOREST PEST CONDITIONS IN 1964

INSECT PESTS. Douglas-fir tussock moth activity increased sharply in 1964. Although the greatest damage from this defoliating insect occurred in Modoc County, infestations are also present in Lassen, Plumas, and El Dorado Counties. These outbreaks damaged white fir stands on 78,210 acres. Although immediate losses have been greatest in infested areas that are being managed for Christmas tree production, tree killing occurred in large poles and young sawtimber, and heavy defoliation caused top kill and serious growth loss in mature trees.

The white-fir sawfly was present at several locations of the central Sierra Nevada and in northeastern California. Usually this insect is not a tree killer, but in 1964 it caused substantial damage in Christmas tree production areas.

The pandora moth, a defoliator of pine, damaged Jeffrey pine stands in Tulare and Kern Counties. This infestation has persisted since 1961. The insect has a two-year-life cycle with heavy feeding occurring only in alternate years. In California, 1964 was a nonfeeding year and the trees had an opportunity to recover somewhat from earlier defoliation.

The lodgepole needle miner declined sharply in the area sprayed in 1963 in Yosemite National Park.

The Mother Lode bark beetle infestation, which reached its peak in 1962, declined to endemic levels in 1964. No serious outbreaks of insects resulted from the windthrow which occurred in the Columbus Day Storm of 1962. Except for local damage, tree killing by bark beetles remained at a low to moderate level throughout the State, but even at the current low levels, bark beetles killed more trees than any other group of insects in California.

Insect pests of young plantations, particularly tip moths and grasshoppers, were a source of serious, although local, damage in 1964. In Fresno County, Modoc County and Mendocino County, grasshopper damage on small plantations has been particularly severe.

Elsewhere in the State, insect activity was local in extent or involved less well known insects. Among these were the black pine leaf scale on sugar pine, Dichelonyx spp. on fir, the fall webworm oak moth and tent caterpillars on hardwoods, a gall midge on fir, a bark scale on oak, twig beetles on pine, and a needle miner on Jeffrey pine.

DISEASE PESTS. There was little change in the California forest disease situation in 1964. In general, the new locations reported for many diseases indicated more thorough detection and better reporting rather than unusual spread.

Root diseases in particular were reported from many new locations and again Fomes annosus was found to be present at a high percentage of the areas where individual small groups of pine trees had been killed by bark beetles.

Seedling losses in forest nurseries again were held to a low level. Minor seedling mortality was reported from three nurseries. The damage at two of the nurseries was caused by a fungus that had done little if any damage there previously, while the causal agent at one nursery is as yet undetermined.

Cytospora canker of red and white fir flared up in a few drainages (Central Sierra and Western Siskiyou Counties), but generally either was unchanged or on the decline.

Other diseases such as the rusts, the dwarfmistletoes, the needle casts, the blights and molds, and southern California's chloratic decline of ponderosa pine, persist with little change from levels previously reported.

ANIMAL PESTS. Porcupines again were responsible for the largest number of detection reports, with deer, pocket gophers and rabbits causing most of the remaining damage reports.

Elk continued to present a problem to Foresters in parts of Humboldt and Del Norte Counties, and the State Fish and Game Department authorized a special hunt to alleviate the problem.

THE STATUS OF FOREST INSECT PESTS

DOUGLAS-FIR TUSSOCK MOTH, Hemerocampa pseudotsugata. Defoliation of white firs by this moth reached epidemic proportions in 1964. Six infestations, totaling about 78,210 acres, were detected, mapped and surveyed on the ground. These infestations are listed below:

Modoc County	- Knox Mountain	59,730
Modoc County	- Stowe Reservoir	470
Modoc County	- Roney Flats	2,280
Lassen County	- Fredonyer Peak	1,600
Plumas County	- Diamond Mountain	12,300
El Dorado County	- Iron Mountain	1,830
	TOTAL - - - - - - - -	78,210

In areas of heavy and medium feeding by this insect some tree killing occurred, top killing was common, and severe defoliation resulted in reduced growth in mature and pole stands of white fir. In the smaller tree classes much killing occurred. In Christmas tree production areas the severe defoliation will make the trees unmerchantable as Christmas trees for many years.

Egg-mass surveys conducted cooperatively by the Forest Service, the California Division of Forestry, and industry, indicate a strong upward trend in tussock moth populations in some infestations, and a static or slightly increasing trend in the remaining infestations. All of the infestations are potentially dangerous and capable of causing additional damage and spread into new areas in 1965.

WHITE-FIR SAWFLY, Neodiprion abietis complex. Feeding damage by this defoliator of white fir was detected at many locations in northern and central California. Activity was most noticeable in Modoc County (Knox Mountain, Stowe Reservoir, Joseph Creek), Siskiyou County (Military Pass-Black Fox), and Calaveras County (Bailey Ridge).

Egg counts made during the winter and spring of 1963-1964 in the Knox Mountain and Bailey Ridge infestations indicated that medium-level populations would exist at some locations. Additional surveys are planned to follow the trend of the infestations.

DOUGLAS-FIR GALL MIDGE, Contarinia pseudotsugae. This insect, and a related species, damaged many Christmas trees in the Jarbo Gap area of Butte County.

PANDORA MOTH, Coloradia pandora. A 7,500-acre infestation of this pine defoliator persisted in the Taylor Meadow-Bartolas Country of Tulare and Kern Counties. The outbreak so far has caused moderate damage in local centers of infestation. Although pupal and egg counts taken in 1964 indicated that the infestation is stable or declining, these findings are based on limited knowledge concerning the insect. The infestations will be kept under close surveillance for at least one more moth generation. A very light population of pandora moth is still present in the Laguna Mountains of San Diego County.

LODGEPOLE NEEDLE MINER, Recurvaria milleri. Survey findings indicate that needle miner populations in the area of Tuolumne Meadows, Yosemite National Park, have declined sharply from epidemic levels two years ago, and that continued control action may not be required. The decline is attributed to the control work which in recent years has been successful in substantially reducing the number of needle miners in the area. Also, natural parasites, which apparently have not been seriously affected by the control work, have increased in number. The survey also revealed that damage to trees inside treated areas was considerably less than where no work had been done.

At Woods Creek, Kings Canyon National Park, needle miner populations were found to be low in stands protected by spraying but considerably higher outside the protection areas. The infestation at Sentinel Meadows, Mono County, is continuing. Population surveys in the Mono County infestation will be made later in the life cycle of the moth.

SPRUCE BUDWORM, Choristoneura fumiferana. Predictions of a decline in the activities of this defoliator were confirmed in the summer of 1964 when no additional damage occurred in the infestation in Modoc County. Another survey of budworm eggs indicated that the spruce budworm would remain at a low level in California in 1965 as well. However, the presence of the budworm on Knox Mountain, approximately 50 miles south of the previous limits of the known infested areas, is now confirmed but no detectable damage was found.

WESTERN PINE BEETLE, Dendroctonus brevicomis. Tree killing by this bark beetle enemy of ponderosa and Coulter pine continued at a rate much reduced from the high losses sustained as recently as 1962. Even at the current endemic level, however, the western pine beetle destroyed a large volume of timber scattered over the range of ponderosa pine in California. The most active infestations this year were at the following locations: Hume Lake, Indian Basin, Balch Park, Tulare County; Pierce Creek, Plumas County; Hat Creek, Grizzly Peak, Shasta County; Saddle Camp, Antelope Creek, Tehama County; Cecilville, McCloud, Siskiyou County; and Beaver Mountain, Parker Creek, Modoc County.

In southern California, the western pine beetle has shown an encouraging decline as well. In maintenance control areas, losses above an acceptable level persist at only two locations; Lake Arrowhead, San Bernardino County; and Ranger Peak, Santa Barbara County. In ten other maintenance control areas, losses have been reduced to an endemic level. However, uncontrolled outbreaks are still active at Julian, Palomar Mountain, and Agua Tibia, San Diego County; and at Crab Flats, San Bernardino County. Control action is being initiated at Agua Tibia and Crab Flats.

MOUNTAIN PINE BEETLE, Dendroctonus monticolae. Serious damage to pole and young sawtimber-size ponderosa pine continues at Joseph Creek and Fort Bidwell in Modoc County. Thinning projects undertaken to reduce overstocking of the Joseph Creek stand and to increase individual tree vigor, are beginning to produce the desired results. The heavy losses in young sugar pine at Miami Creek, Mariposa and Madera Counties, and at Shaver Lake, Fresno County, reported last

year have subsided. Logging to remove infested trees and to thin overstocked stands is believed to have aided materially in reducing losses at Miami Creek.

Throughout central and northern California a persistent, high-endemic loss of mature sugar pine continues. In most areas, infested trees are too widely scattered to permit effective control work. Infestations are most noticeable in the general area of Balch Park and Hume Lake, Tulare County; Grizzly Peak, Shasta County; Happy Camp and McCloud, Siskiyou County; Antelope Creek, Tehama County; and Pierce Creek, Plumas County. In addition, the mountain pine beetle is active in lodgepole pine at Summit Meadows of the Kern Plateau, and at Goosenest and Skunk Cabbage in Modoc County.

DOUGLAS-FIR BEETLE, Dendroctonus pseudotsugae. The threatened outbreak of the Douglas-fir beetle in windthrown timber from the Columbus Day Storm of 1962 has so far failed to develop. However, local problems resulting from beetle buildup in windthrown Douglas-fir, have been reported in some areas. Such a problem was recently evaluated on the Hoopa Valley Indian Reservation. Other areas of fairly concentrated loss are Bluff Creek, Humboldt County; and Fort Goff, Siskiyou County. Logging of infested trees this fall and next spring will continue and will aid in suppressing this beetle. Prompt salvage of windthrow by all land managers following the Columbus Day Storm probably averted the serious losses that were expected in the spring of 1964.

FIR ENGRAVER, Scolytus ventralis. The Statewide outbreak of this beetle that was reported as continuing at a fairly high level last year largely subsided in 1964 with only a few centers of infestation remaining active. Two centers are Cedar Pass in the Warner Mountains, and Squaw Valley, Plumas County.

JEFFREY PINE BEETLE, Dendroctonus jeffreyi. Tree killing in Jeffrey pine by this bark beetle has continued in the southern Warner Mountains, Modoc County; Butte Creek, Lassen County; the Summit Meadows area of the Kern Plateau; and Thomas Mountain, Riverside County. Elsewhere in the State, the Jeffrey pine beetle activity remained at a low level.

IPS, Ips spp. Ips problems were reported from several locations in central and northern California in 1964, but only a few serious attacks have occurred in standing trees of commercial species. If precipitation is adequate next spring, standing trees are expected to remain resistant to ips attacks. The most threatening problems reported to date concern the widespread killing of knobcone pine around Cecilville and McCloud in Siskiyou County and Alder Creek, San Bernardino County. These infestations may jeopardize adjacent ponderosa pine stands next year.

RED TURPENTINE BEETLE, Dendroctonus valens. Red turpentine beetle activity has subsided to an endemic level in all portions of the State.

CALIFORNIA FLATHEADED BORER, Melanophila californica. Tree killing by this beetle remains serious only in Garner Valley, Riverside County. Elsewhere in the State the California flatheaded borer killed only occasional trees.

TABLE 1--FOREST INSECT CONTROL ACTIONS RECOMMENDED BY THE COUNCIL

INFESTATION AREA	ESTIMATED ACREAGE	COUNTY	INSECT	HOST	RECOMMENDED ACTION
BARK BEETLES					
All National Forests, State Forests, Private Timber Land Managers Bureau of Land Management Bureau of Indian Affairs	*	Statewide	Db,Dm,Dj,Sv,Dp, Dv,Mc	PP,JP,SP,WF, DF,LP	Sanitation-salvage, log infested trees with chemical sprays where warranted.
All National Forests	*	Statewide	Ips	KP	Surveillance
Bass Lake	9,000	Madera	Db,Ips,Dm	PP,SP	Maintenance control
Butte Creek	3,000	Lassen	Dj	JP	Log infested trees
Hume Lake-Indian Creek	2,000	Fresno	Db,Dm	PP,SP	Log, fall and spray
Cherry Flat	1,000	Tulare	Db	PP	Maintenance control
Capinero	300	Tulare	Db	PP	Log, fall and spray
Ice House Cooperative	2,000	El Dorado	Db	PP	Log, fall and spray
Joseph Creek	1,000	Modoc	Dm	PP	Thinning, surveillance
Miami Creek-Lewis Fork	10,800	Madera, Mariposa	Dm	SP,PP	Log and thin
Reds Meadow	1,000	Mono	Dj,Dm	JP,LP	Cut and spray, or protective spray
Sly Park Cooperative	1,000	El Dorado	Db	PP	Log, fall and spray
South Warners	12,000	Modoc	Db,Dm,Dj	PP,SP,JP	Log infested trees and sanitation-salvage
Mt. Hebron	1,000	Siskiyou	Dm	LP	Log infested trees
Saddle Camp	1,000	Tehama	Db	PP	Log infested trees
Hoopa	10,000	Humboldt	Dp	DF	Log infested trees
Grizzly Peak	*	Siskiyou	Db,Dm	PP,SP	Log where possible
DEFOLIATORS					
Diamond Mt. Cooperative	12,300	Lassen, Plumas	Hp	WF	Aerial spray - DDT
Fredonyer Pass	20	Lassen	Hp	WF	Surveillance
Fredonyer Peak - B.L.M.	1,600	Lassen	Hp	WF	Aerial spray or research
Iron Mt.-Peddler Hill Cooperative	1,830	Amador, El Dorado	Hp	WF	Surveillance
Knox Mt. Cooperative	59,730	Modoc	Hp	WF	Aerial spray - DDT
Pinecrest	600	Tuolumne	Hp	WF	Surveillance
Roney Flats	2,280	Modoc	Hp	WF	Aerial spray or research
Stowe Campground	470	Modoc	Hp	WF	Aerial spray - DDT
Ross Creek	40	Modoc	Hp	WF	Surveillance
Hazelton Springs	100	Modoc	Na	WF	Surveillance
Browns Canyon	200	Lassen	Na	WF	Surveillance
Crystal Lake	100	Los Angeles	Nr	Pinyon	Surveillance
Military Pass, Black Fox	13,000	Siskiyou	Na	WF	Surveillance
Warner Mts.	2,000	Modoc	Na	WF	Surveillance
Bailey Ridge	600	Calaveras	Na	WF	Surveillance
Taylor Meadows-Bartola	7,500	Tulare, Kern	Cp	JP	Surveillance
Laguna Mts.	1,000	San Diego	Cp	JP	Surveillance
Warner Mts.	5,000	Modoc	Cf	WF	Surveillance
Eel River Plantation	100	Mendocino	G	PP	Evaluation and control by spray
Long Valley Plantation	1,000	Modoc	G	PP,JP	Surveillance
Millflat Plantation	320	Fresno	G	PP	Surveillance
Northeast California	*	Siskiyou, Modoc, Lassen	Aw	B&R	Evaluation and Research
Emigrant Basin	400	Tuolumne	Rm	LP	Surveillance
Crooked Meadow	10	Mono	Rm	LP	Surveillance
Sentinel Meadows	2,200	Mono	Rm	LP	Surveillance
Snow Valley	100	San Bernardino	Nm	JP	Surveillance
Richie Creek	1,000	San Diego	Tc	O	Surveillance
Laguna Mts.	7,000	San Diego	Tc	O	Surveillance
San Sevaine	700	San Bernardino	Tc	O	Surveillance
PLANTATIONS AND EXPERIMENTAL AREAS					
Institute of Forest Genetics	2,000	El Dorado	Db,Ips	PP	Treat infested trees
Plantations	*	Statewide	Ce,Misc.	PP,JP,SP,DF	Detection and evaluation as needed
Seed Production Areas	*	Northern California	O&S	PP	Evaluation, research
STATE AND NATIONAL PARKS					
Cuyamaca Rancho State Park	8,000	San Diego	Mc,Db	JP	Maintenance control
Lassen Volcanic National Park	3,000	Shasta, Lassen	Dj,Db,Dm	JP,PP,SP,LP	Maintenance control
San Jacinto State Park	700	Riverside	Db,Ips	CP,PP	Maintenance control
Sequoia and Kings Canyon	8,500	Fresno	Db,Dm	PP,SP	Maintenance control
Sequoia and Kings Canyon	400	Tulare	Rm	LP	Surveillance
Yosemite National Park	57,700	Mariposa, Tuolumne	Db,Dm,Dj	PP,SP,JP,LP	Maintenance control
Yosemite National Park	5,000	Tuolumne	Rm	LP	Surveillance
SOUTHERN CALIFORNIA FOREST RECREATION AREAS					
Arrowhead-Crestline	46,000	San Bernardino	Dm,Db,Ips,Dj	PP,CP,JP	San.-salvage and maintenance control
Arrow Seco	*	Los Angeles	Db,Ips,Mc	PP,CP,JP	San.-salvage and maintenance control
Agua Tibia Wild Area	400	San Diego	Db,Ips	CP	Treat infested trees
Crab Flats	1,000	San Bernardino	Db	PP,CP	Log or treat infested trees
Alder Creek	300	San Bernardino	Ips	KP	Surveillance
Big Bear Valley	8,800	San Bernardino	Dj,Ips,Mc,Sv	JP,WF	Log and maint. control according to plan
Corte Madera	1,600	San Diego	Db,Ips,Mc,Dv	CP,JP,PP	Maint. control according to plan
Idyllwild-San Jacinto	37,000	Riverside	Mc,Db,Ips,Dm	PP,CP,JP	San.-salvage and maintenance control
Laguna Mt.	9,700	San Diego	Db,Mc	CP,JP	Maint. control according to plan
Lost Valley	4,000	San Diego	Db,Ips	CP	Maint. control according to plan
Mt. Baldy District	1,500	Los Angeles	Ips,Dj,Dm,Mc,Db	PP,JP,CP	San.-salvage and maintenance control
Mt. Pinos District	7,900	Ventura, Kern	Mc,Ips	JP	San.-salvage and maintenance control
Palomar Mt.	6,600	San Diego	Db,Sv	CP,WF	Surveillance
San Gorgonio District	25,000	San Bernardino	Db,Dj,Ips	PP,JP,CP	San.-salvage and maintenance control
Ranger Peak-Figueroa Mt.	700	Santa Barbara	Db,Ips,Dv	PP,CP	Fire salvage and maintenance control
Valyermo	14,600	Los Angeles	Mc,Ips	JP,WF	San.-salvage and maintenance control
Wrightwood	7,700	San Bernardino	Mc,Ips	JP	Maintenance control
Julian	5,000	San Diego	Db,Ips	CP	Surveillance

*Acreage not known.

Abbreviations Used in Tables

INSECTS

Aw - Aroga websteri
Ce - Pine Reproduction weevil
Cf - Spruce Budworm
Cp - Pandora Moth
O&S- Cone and seed insects
Db - Western pine beetle
Dj - Jeffrey pine beetle
Dm - Mountain pine beetle
Dp - Douglas-fir beetle
Dv - Red turpentine beetle
Rm - Lodgepole needle miner
Hp - Douglas-fir tussock moth
Ips- Pine ips
Mc - California flatheaded borer
Na - White-fir sawfly
Sv - Fir engraver
Tc - Tent caterpillars
G - Grasshoppers
Nr - Pinyon sawfly
Nm - Needle miner

HOSTS

B&R - Browse and Range plants
CP - Coulter pine
DF - Douglas-fir
JP - Jeffrey pine
KP - Knobcone pine
LP - Lodgepole pine
O - Oak
PP - Ponderosa pine
PY - Pinyon pine
RF - Red fir
SP - Sugar pine
WF - White fir

TWIG BEETLES. Heavy twig killing on Torrey pine by twig beetles caused much local concern at Del Mar, San Diego County. The problem apparently resulted from unseasonably cold weather, resulting in damage to the terminals. Similar conditions of heavy twig beetle attacks on frost-injured twigs occurred at Heaps Peak, San Bernardino County, and in Jeffrey pine at Mt. Pinos, Ventura County.

PLANTATION INSECTS. Serious damage to young pine plantations due to heavy feeding by the grasshopper, Melanoplus devastator, occurred in three locations in 1964: the Good Mill Plantation in Fresno County; Long Valley in Modoc County; and the Eel River Plantation, Mendocino County.

The ponderosa pine tip moth, Rhyacionia zozana, and the pine needle sheath miner, Zelleria haimbachi, were unusually active at the Institute of Forest Genetics near Placerville. The tip moth was also responsible for minor, localized damage in other plantations, notably the Chaparral Plantation in Butte County. The high-value planting of grafted, rust-resistant sugar pine and other pines at Badger Hill near the Institute was sprayed to protect the pines against tip moth attack; none of the other infestations warranted chemical control.

Very few reports of damage by the pine reproduction weevil, Cylindrocopturus eatoni, were received in 1964 although the weevil is known to be active in several areas.

CONE AND SEED INSECTS. Damage by cone and seed insects declined in 1964.

BROWSE AND RANGE INSECTS. The destruction of sagebrush by the sagebrush defoliator, Aroga websteri, continued in epidemic status in Modoc, Siskiyou and Lassen Counties. Extensive areas of sagebrush, heavily defoliated in 1963, are now dead. Heavy parasitism was found in the Aroga population in many areas, suggesting a possible decrease in defoliation and damage in 1965.

OTHER INSECTS. The black pine leaf scale caused a serious top decline of sugar pine over local areas near Callahan, Siskiyou County. A small outbreak of a Jeffrey pine needle miner, discovered last year at Snow Valley, San Bernardino County, is still present but so far has not caused any serious damage.

The fall webworm continued defoliating madrone and other hardwoods along the Klamath River in Siskiyou County, and a small outbreak was reported near Placerville.

A small outbreak of the oak moth, was discovered near Orleans, Humboldt County. A bark scale, Asterolecanium minus, caused considerable damage to interior live oak near Garberville. Dichelonyx spp. destroyed much of the new growth on white fir in the vicinity of Black Fox, Siskiyou County. (In 1962 this beetle destroyed many of the new cones on ponderosa pine in valuable seed orchards.) In southern California, a new outbreak of the blue-sided tent caterpillar on oak developed in the San Servaine portion of San Bernardino County and at Richie Creek, San Diego County. The pinyon sawfly also is still present in low numbers in the vicinity of Crystal Lake, Los Angeles County. The balsam fir gall midge, Cecidomyia balsamicola, was collected for the first time on white fir in California near Susanville, Lassen County, and at Knox

Mountain, Modoc County.

UNDETERMINED PROBLEM OF DOUGLAS-FIR. A rather widespread top decline of Douglas-fir reproduction has been reported near Orick, Humboldt County. The cause of this disorder has not yet been determined. A wooly aphid is associated with the damage, but a disease organism of physiological condition is more likely responsible.

THE STATUS OF FOREST DISEASES

ROOT DISEASES. The inference that root diseases frequently set the stage for subsequent bark beetle attacks is strengthened by new evidence each year. Again in 1964 root diseases were found at many of the centers of insect-killed trees. At most centers the root diseases had been present long enough to weaken or kill one or more of the initial-attack trees that precipitated the bark beetle buildup. Numerous new infection centers of Fomes annosus, several of Armillaria mellea and two of Verticicladiella wagenerii were found during the year.

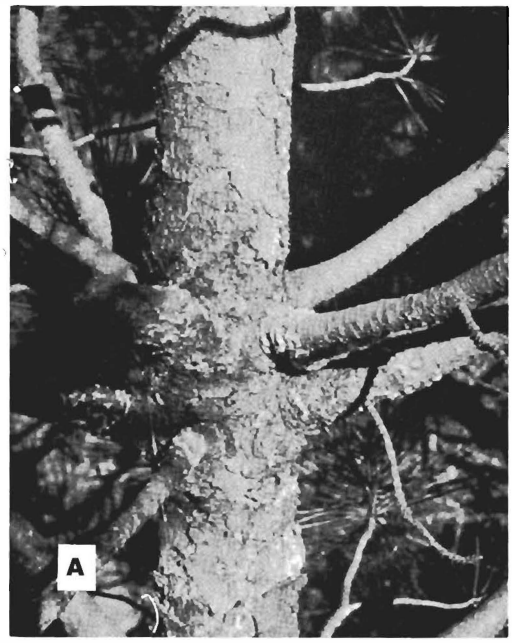
Fomes annosus. This root disease may assume increased importance in California with its appearance in plantations and in thinned young-growth stands. About 50 new infection centers of F. annosus, were found scattered throughout the State in 1964. Infection centers were found in and adjacent to road right-of-way clearings, in thinning areas, in several plantations, in the Cal Mountain seed production orchard, (Lassen County) in numerous cutover stands (particularly on poor growing sites), as well as in a few undisturbed forests. In many cases, insect attacks were linked with the disease, but in others trees were killed by the disease alone. At most of the centers the fungus is now gradually killing reproduction of all tree species surrounding them. Mature Jeffrey and ponderosa pine in these infection centers were also subject to root disease damage. In the past few years F. annosus has been found on: Douglas-fir, white fir, red fir, sugar pine, Jeffrey pine, ponderosa pine, lodgepole pine, Monterey pine and incense-cedar. Fomes annosus sporophores were found on manzanita at one center. The disease remained active at previously known locations such as Boggs Mountain State Forest, Blacks Mountain, and in the arboretum at the Institute of Forest Genetics. The disease has added Santa Lucia fir, Abies bracteata, and jelicote pine, Pinus patula, to about 25 other pine species already killed at the Institute of Forest Genetics.

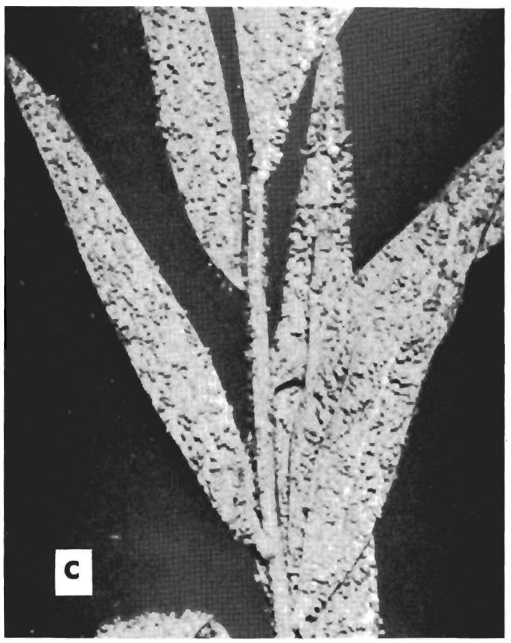
Armillaria mellea. New centers of Armillaria root rot continue to be found. The disease is quite prevalent where oak is a component of the stand, and plantations with oak stumps present are particularly subject to damage within a 20- to 30-foot radius of each stump. This fungus killed young trees at several plantations as well as at numerous other locations throughout the State. At one privately owned plantation, trees of Douglas-fir, white fir, ponderosa pine and redwood had been killed. Douglas-fir trees as large as 14 inches in diameter were killed in Mendocino County and the roots of a large redwood tree in Humboldt County were found to be rotted by this fungus. Previously known to be present in many campgrounds, Armillaria root rot was found in a few more in 1964.

Verticicladiella wagenerii. The dark-staining root and butt disease caused by this fungus was found on Jeffrey pine beside Butte Creek near the Lassen National Forest - Lassen Volcanic National Park boundary. Another center, on pinyon pine, was located near Sierra View Point in the White Mountains of Inyo County. Previously known centers are still active.

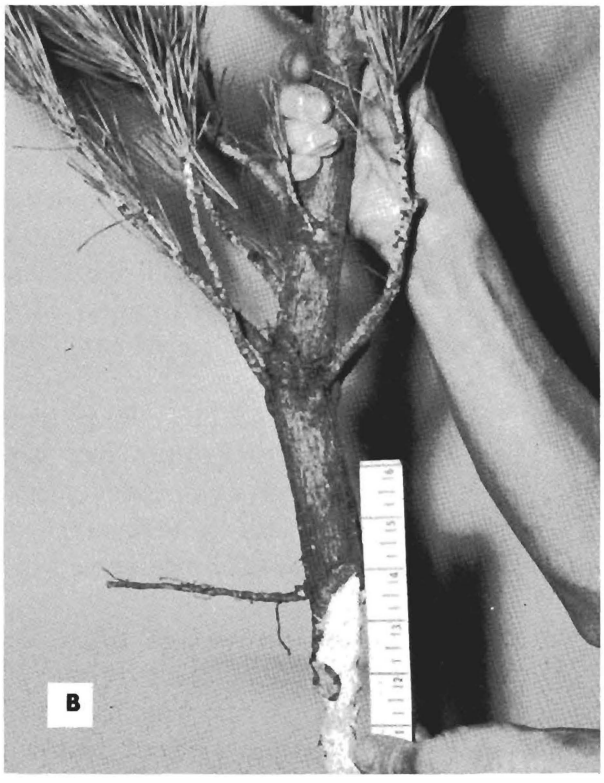
NURSERY DISEASES. Some Douglas-fir loss at the Humboldt Nursery was caused by a species of Phomopsis. Losses in white fir occurred at the Magalia Nursery late in the growing season from a yet undetermined cause. A root fungus Macrophomina

INSECT PESTS Outbreaks of the Douglas-fir tussock moth damaged white fir stands at several locations in California in 1964. These illustrations show both the extensive nature of the infestations and the severity of attack on individual trees. (A) The defoliated fir appears white in contrast with the dark, uninfested pine. (B) Young firs from the hillside illustrated in A; these trees were completely defoliated and probably will die. (C) A closeup of tussock moth defoliation.





DISEASE PESTS Comandra rust, Cronartium comandrae, requires alternate hosts in its life cycle. Leaf and stem infections occur on the inconspicuous shrub, bastard toad flax, (B) while the disease produces severely damaging branch and bole cankers on the pine host, (A). The closeup of spore pustules on the toad flax is shown in (C). The examples shown here were taken from a plantation in northern California where several hundred trees are lethally infected.



ANIMAL PESTS Damage by animal pests in young plantations continued to plague land managers throughout California in 1964. Two of the less well known, but serious animal pests are represented in the illustrations. The screens surrounding the thrifty, young pine seedlings (A) will protect them from rabbit gnawing. The four-year-old ponderosa pine (B) was killed by pocket gophers; ground line was at the top of the rule.

phaseoli, caused considerable loss in 1-0 stock and even more loss in 2-0 stock of white fir at the Institute of Forest Genetic's Nursery in an unfumigated seedbed.

NEEDLE DISEASES. Although several different needle diseases were reported, there was little change from last year in the intensity of most needle blights, casts and molds. Rhabdocline pseudotsugae on Douglas-fir needles was reported from Tuolumne County to Siskiyou County. Elytroderma deformans on the needles of ponderosa and Jeffrey pine was frequently noted and one heavily infected stand near the Butte Creek entrance of Lassen Park was examined. Other diseases reported on needles of these and other pines were: Lophodermium pinicolum, Naemacyclus niveus, Hypodermella medusa and Coryneum cinereum (the latter being quite common on ponderosa pine in the Mad River and Klamath River drainages). Dothichiza pithyophila was found damaging ponderosa pine in one plantation. Hypodermella arcuata on sugar pine needles in Siskiyou County near Hilt did considerable damage as this was the second consecutive year of heavy infection. Lophodermina nitens was common on older needles of sugar and western white pine.

White and red fir supported several needle diseases, but all in endemic amounts. These were: Herpotrichia nigra, Hypoderma robustum, Hypodermella abietis-concoloris, Hypodermella punctata, Lophodermium decorum, Atichia glomerulosa, Phacidium infestans var. abietis, Stegopezizella balsameae, Gloeosporium balsameae and a species of Cenangium. Mycosphaerella sequoiae was found killing the foliage on some young redwood trees as well as sprouts. Hypoderma pini was common on needles of pinyon pine in some areas.

DWARFMISTLETOE. Although many new stands infected with dwarfmistletoe were reported, the overall picture has not changed. The prevalence of dwarfmistletoe by tree species is shown in Tables 2 and 3 which summarize the Forest Disease Survey results for the past seven seasons. Dwarfmistletoe (Arceuthobium campylopodum forma either blumeri or tsugensis) was found for the first time on foxtail pine (Pinus balfouriana). The infected foxtail pine trees were growing either near or under heavily infected trees of western white pine in the High Camp Creek area on the northern shoulder of Mt. Eddy in Siskiyou County.

CONIFEROUS RUSTS. Precipitation was generally below normal between January and June, and conditions for rust spread were not too favorable. There was little spread of blister rust from pine to ribes during the spring and most of the spread that did occur was within a few hundred feet of the infected pine. Pinyon rust on ribes was generally scarce.

A small scale survey of the Comandra rust at the Long Valley Plantation near Burney Falls revealed that over 1,000 trees had been infected during the spread year (probably 1958). Of 106 infected trees found on the survey 105 were ponderosa pine and the other was Jeffrey pine. This is the only tree of Jeffrey pine found infected with Cronartium comandrae during the current detection program. One small patch of the alternate host, bastard toad flax, Comandra umbellata, was found in the area. When these host plants were re-examined in the fall, many of them were found to be infected with comandra rust. New centers of limb rust, stalactiform rust, yellow

witches' broom, gall rust and incense-cedar rusts were reported on their specific hosts.

CYTOSPORA CANKER OF TRUE FIR. Cytospora in conjunction with dwarfmistletoe was doing much damage to red fir in one drainage in the Callahan area. Another area of red fir in Tehama County was severely flagged and some small areas of red and white fir were damaged in Fresno County. Since precipitation was only about 70 percent of normal in many areas, Cytospora damage may show an upward trend, especially should another year of subnormal rainfall follow.

NONINFECTIOUS DISEASES. Logging damage, that favors entrance of heart rots, was prevalent at all cut-over areas visited in 1964. Most injuries were to the lower bole where the bark had been torn off exposing the sapwood and occasionally the heartwood. Heart rots frequently enter through such wounds. Basal trunk wounds in red fir, white fir, and Douglas-fir are especially subject to heart and root rot infection. The frequency of bole wounding is illustrated by data from a single Forest Disease Survey plot: eighteen of 25 trees (each plot consists of 25 trees) had received one or more bole wounds during the logging operation performed two years earlier.

It is possible to lessen the amount of cull in future timber crops by reducing the damage to young trees left in the residual stand.

Other forms of noninfectious damage noted in 1964 include that which resulted from low winter temperatures, late frosts (after growth had started), strong, dry winds particularly during the succulent stage of early growth, and drought. Chemical damage ranging from chemicals used along the highway in snow areas, fertilizers and weed killers used in nurseries, and spray used to kill brush in plantations was reported frequently. A few cases of cone fade (where the tip of a sugar pine limb dies after it has produced a heavy cluster of cones) were reported.

MISCELLANEOUS DISEASES. From one to several specimens of the following fungi were examined and identified in 1964.

1. On quaking aspen: a powdery mildew Uncinula salicis; a leaf and twig blight Marssonina populi; another leaf disease caused by a species of Mycosphaerella; a canker of twigs, limbs and stem Cytospora chrysosperma; the ink spot leaf disease Sclerotinia bifrons; and a leaf rust Melampsora albertensis.

2. In addition to diseases already listed, Cenangium ferruginosum, Godronia pinicola, and Diplodia pinea were found killing twigs of ponderosa and Jeffrey pines both in natural stands and in plantations.

3. Heart rots and other wood rotting fungi reported are: Echinodontium tinctorium on red and white firs; Fomes pini on Douglas-fir, white fir sugar pine and ponderosa pine; Ganoderma oregonense on red fir, Lentinus lepideus on ponderosa pine, Fomes pinicola on ponderosa pine; Pholiota adiposa on white fir; Fomes

subroseus on Douglas-fir Polyporus anceps on Jeffrey pine; Merulius americana in a fire scar on Jeffrey pine; Polyporus abietinus on white fir; Polyporus schweinitzii on Jeffrey pine and Douglas-fir; Polyporus volvatus on one side of a living white fir; Polyporus amarus on incense-cedar, Polyporus sulphureus on red fir, Fomes officinalis on ponderosa pine, lodgepole pine and Douglas-fir, and Fomes juniperinus on western juniper. To illustrate the seriousness of heart rots, over 14 percent of all trees examined were found to be infected with one or more wood rotting fungi.

4. Other diseases reported included a rust Puccinia caricina on ribes leaves, Tuberculina maxima a parasite on white pine blister rust, Fusarium lateritium killing silk tree, Godronia zelleri on sugar pine twigs, Scleroderris abieticola a bark canker on white fir, Cephalosporium sp. on the roots of a dying sugar pine graft, Botryosphaeria ribis on twigs of madrone, Coryneum pustulatum and an unidentified Cytospora on chestnut, Mycosphaerella caespitosa and Gnomonia veneta causing leaf spots on oak.

UNKNOWN DISEASES. An unknown decline of tanoak was observed in the area west of Ukiah. At times insects were associated with the afflicted trees and about as frequently a staining fungus was found. Severe decline, sometimes resulting in the death of the affected tree, was most prevalent in heavily logged stands and along road cuts where the tanoak trees were directly exposed to sunlight and perhaps other adverse factors. The cause of decline is yet undetermined but further investigation is planned.

Big leaf maple appeared to have a blight that inhibited full leaf development and caused a browning of the leaf margins. Sometimes only the terminal growth was affected but in other trees the entire leaf complement was dwarfed. This blight in varying degrees of intensity was reported from central Oregon to Yosemite National Park.

TABLE 2
DWARFMISTLETOE INFECTION, 1958 - 1964

Species	Total Plots	Infected Plots	Percent Plots Infected	Total Trees	Infected Trees	Percent Trees Infected
PP	405	92	22.7	4,380	439	10.0
JP	166	24	14.5	1,530	96	6.3
SP	273	59	21.6	967	99	10.2
LP	71	20	28.2	834	218	26.1
WF	372	106	28.5	3,882	637	16.6
RF	103	47	45.6	1,136	412	36.3
DF	262	12	4.6	2,785	45	1.6

TABLE 3--FOREST DISEASE SURVEY DATA 1958 - 1964

TREE SPECIES	TOTAL SAMPLE UNIT	TOTAL SAMPLE NO.	INFECTION BY NUMBER OF PLOTS AND TREES: DWARFMISTLETOE	TRUE MISTLETOES	ELYTRODERMA DEFORMANS	OTHER NEEDLE CASTS	UNCLASSIFIED FOLIAGE	CRONARTIUM RIBICOLA	GYMNOSPORANGIUM LIBOCEDRI	MELAMPSORELLA CARY.	PERIDERMIUM HARKNESSII	P. STALACTIFORME	CYTOSPORA ABIETIS	UNCLASSIFIED LIMB CANKER	ECHINODONTIUM TINCTORIUM	FOMES PINI	POLYPORUS SCHWEINITZII	X-DISEASE	UNCLASSIFIED HEART ROTS
Ponderosa Pine	Plot	405	92		90	143	11				10					14		4	94
	Trees	4380	439		332	484	34				17					22		27	164
Jeffrey Pine	Plot	166	24		41	45	2				4	1							27
	Trees	1530	96		176	129	3				10	1							51
Sugar Pine	Plot	273	59			19	11	11								4	1		50
	Trees	967	99			24	17	17								4	1		63
Lodgepole Pine	Plot	71	20		1	4	3				23			20			1		25
	Trees	834	218		1	17	9				69			57			1		65
Incense-Cedar	Plot	292		65		2			252										111
	Trees	1559		129		3			1092										453
White Fir	Plot	372	106	25		42	36			6			143	17	24	3	1		234
	Trees	3832	637	63		90	123			10			517	28	37	4	1		718
Red Fir	Plot	103	47			2	5			14			90	6	5				59
	Trees	1136	412			2	5			34			205	18	7				190
Douglas-Fir	Plot	262	12			7	13							58		92	25		125
	Trees	2785	45			25	24							263		224	33		330
Juniper	Plot	46		3		1	5												12
	Trees	195		6		3	15												19
Redwood	Plot	22																	12
	Trees	386																	171
Knobcone Pine	Plot	10	8		1	2					1								1
	Trees	57	33		1	5					7								1
Western Hemlock	Plot	5	1																4
	Trees	33	5																6
Western White Pine	Plot	25				3		2											8
	Trees	87				8		3											8
Digger Pine	Plot	6	1			1					1								
	Trees	13	1			4					1								

PORCUPINES. Although the reports of damage declined in 1964, the porcupine population in California should be building up again. Big populations occurred in 1950 and 1958. If the cycle is on schedule, 1966 should be a high year. The major areas of damage occurred in the northeastern counties and in the Sierra region. A report of porcupine attacking redwoods was received from Fort Bragg in Mendocino County. This damage may have been mistaken for the work of tree squirrels. Baiting of porcupine dens, the use of the Weyerhaeuser-typebait box, and shooting were the primary tools of control.

DEER. The major portion of deer damage was reported on newly established plantations. In several of these plantations deer damage resulted in the loss or stunting of more than one-half of the seedling trees. Repellents were used more extensively than ever before in the establishment of new plantations. They gave some relief to deer depredation, but much work is needed in the development of better repellents and more economical application techniques for these materials.

The State Department of Fish and Game authorized a depredation hunt to reduce damage in selected areas of the North Coast Redwood Region.

POCKET GOPHERS. Pocket gophers caused serious damage to young plantations and appeared to be on the increase. Generally, gopher damage does not show up until the second or third year after planting. Gophers are first attracted into the plantation by the broadleaf plants that become established. During the later winter and early spring when the preferred broadleaf plants are gone, they turn to the plantation stock as a source of food. Damage occurs mainly to the root zone but during periods of heavy snow they may also attack the upper portion of the trunk by burrowing through the snow. Damage was reduced on several plantations by probing runways and hand baiting with toxic grain or vegetable bait.

SQUIRRELS. Bark stripping from limbs and tree trunks was the major type of damage reported. This bark stripping occurs in the late winter and early spring. Apparently, the animals strip the bark to gain access to the cambium layer beneath. During the past several years, damage by these animals has been particularly noticeable in the redwood reproduction along the coastal areas of the State.

RABBITS. Rabbits continue to be the cause of considerable clipping damage to young plantation stock. Most of the damage occurred on plantations in the pine regions of the northeastern counties. Rabbit damage can usually be determined by the clean, knife -like, oblique cut on the remaining portion of the stems, and by the presence of rabbit droppings in the immediate area. The application of repellents to protect seedling stock from rabbits and other animal pests is becoming a standard practice on most plantations. This provides only temporary protection, however, becoming ineffective as new growth appears.

WOODRATS. Leader clippings to Douglas-fir reproduction was the major form of damage. Thus far, no instance of damage has been extensive enough to warrant control.

ELK. Elk continued to present a problem to foresters in the coastal area of Humboldt and Del Norte Counties. In an effort to help alleviate the problem, the State Fish and Game Department held a special elk hunt in the Prarie Creek area on November 14, 1964 with one hundred permits being issued.

BEAR, DEER, MICE AND BIRDS. Damage occurred but nothing unusual was reported.

Although the detection and evaluation of pest conditions are initial steps in control action, it is the prevention of pest damage or, when necessary and justified, the suppression of forest pests that is the primary concern of land managers. The following paragraphs highlight forest pest prevention and suppression activities in California in 1964.

INSECT CONTROL. As in previous years, the principal means of bark beetle control in California was sanitation-salvage logging supplemented with chemical treatment where needed. In 1964 salvage and sanitation sales were continued by private, State and Federal land managers. Insect-infested trees removed from National Forest lands in Fiscal Year 1964, amounted to 74,550 MBM, slightly below the average of past years. Logged volumes from private lands have been comparable to those from Federal lands in past years. The well coordinated salvage effort of recent years has been instrumental in holding bark beetle populations to the present low level.

On forest recreational lands, chiefly in the National Parks and in the Southern California National Forests, maintenance control operations aimed at holding bark beetle populations to an endemic level were continued.

Outbreaks of three defoliating insects, the white-fir sawfly, the Douglas-fir tussock moth, and grasshoppers, required emergency suppression action during the year.

White-fir sawfly. Christmas tree production areas near Knox Mountain in Modoc County were sprayed to control white-fir sawflies in a project involving the State, industry and Federal Government. The California Division of Forestry with assistance from industrial foresters administered the project, while the entomological phases were handled by the University of California and Forest Service entomologists. Specialists from the California Department of Fish and Game and U. S. Bureau of Sport Fisheries and Wildlife monitored the project for undesirable side effects. Other State and Federal agencies gave indirect aid through suggestions and recommendations.

As a part of the project DDT was applied on 2,880 acres by fixed-wing aircraft at the rate of 3/4 pounds in 1 gallon of diesel oil per acre. In a separate infestation, and as a pilot test, malathion was applied on 320 acres at the rate of 1 pound in one gallon of diesel oil per acre. Both insecticides were effective, achieving a 99 percent kill.

Douglas-fir tussock moth. In an effort to control an outbreak of Douglas-fir tussock moth that had severely defoliated white firs in the Stowe Reservoir Campground in Modoc County, malathion was applied on 200 acres by helicopter at the rate of 1 pound in one gallon of diesel oil per acre. Although malathion was effective against the white-fir sawfly, the kill was poor with this insecticde on Douglas-fir tussock moth at Stowe Reservoir Campground.

Aerial surveys were made of all known Douglas-fir tussock moth outbreaks in the State to determine the boundaries of each infestation and the degree of damage. In addition, to supply data for forecasting trends, egg masses were collected from 300 sample points over a gross area of 80,000 acres. State, private and Federal agencies participated equally in the project.

Grasshoppers. In 1963 grasshoppers infesting the six-year-old Mill Flat Plantation on the Sequoia Forest severely defoliated ponderosa pines on six acres with lighter feeding occurring on an additional 320 acres. Pupal counts, from the Plant Pest Control Division of Agricultural Research Service, indicated severe defoliation would occur over the entire plantation unless control measures were taken in 1964.

On June 13 the Agricultural Research Service, which is responsible for control of grasshoppers on both agricultural and forest lands, applied the insecticide, Sevin, by fixed-wing aircraft at the rate of 1/2 pound in one gallon of water per acre on 320 acres of the Mill Flat Plantation. Control was effective.

DISEASE CONTROL. Disease control operations in 1964 consisted chiefly of blister rust control on nine National Forests, two National Parks, four State Forests and Parks, and numerous private holdings. A notable feature of the 1964 blister rust control program was the contracting of pre-eradication surveys on about 20,000 acres. Previously such surveys were performed by hired crews.

Dwarfmistletoe detection and suppression projects were carried out on both commercial forest lands and on recreation lands throughout the State in 1964. Most National Forests now have an active control program, and Kings Canyon National Park initiated a survey and evaluation project during the year.

The control of root diseases was continued at the Institute of Forest Genetics, Placerville, where Fomes annosus threatens valuable arboretum trees, and in Forest Service nurseries throughout the State where seedbed fumigation is now an accepted management practice.

ENDORSEMENTS BY THE CALIFORNIA FOREST PEST CONTROL ACTION COUNCIL - 1964

At its annual meeting in November, the Council took the following action:

1. Endorsed insect suppression projects listed in Table 1.

2. Recommended a Zone of Infestation around the Diamond Mountain Douglas-fir tussock moth infestation in Lassen and Plumas Counties.

3. Adopted resolution to promote studies on sampling Douglas-fir tussock moth populations and relating population to resulting damage in white fir.

4. Endorsed recommendations made by Northwest Pest Action Council on European pine shoot moth in Pacific Northwest.

5. Endorsed the request from Pacific Northwest Forest and Range Experiment Station to try out a tussock moth virus in California (2,000 acres).

6. Endorsed the objectives of a study on Wildlife and Forest Regeneration Relationships, as proposed by Howard.

7. Adopted a resolution endorsing the recommendations made by Northwest Pest Action Council to the Bureau of Sport Fisheries and Wildlife of October 23, 1964 on more research on pesticides, fish and wildlife to meet the pressing needs of forest land managers.

8. Adopted a resolution to promote studies on protection from Fomes annosus root rot, including stump treatments.

9. Approved a brochure on "Deer Exclosures on Forest Land" and a report on "Animal Damage Survey - 1962." Editorial Committee to seek means to publish them as contributions from this Council.

10. Election of Council Officers: John Callaghan, Chairman; Professor Ron Stark, Vice Chairman; Ronald Hawthorne, Secretary.